

STUDY OF ROLE OF HEREDITY IN CANCER IN THE POPULATION OF HIMACHAL PRADESH

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Abstract

Medical genetics is an aspect of human genetics that is concerned with the relationship between heredity and disease. Through genetics, a number of specific disorders have been identified as being genetically caused. Increasing trend of cancer incidence has necessitated, man to work for cancer prevention and treatments. According to epidemiological studies, 80-90% of all cancers are due to environmental factors of which life style related factors are the most important and preventable. Many cancers do not run in families at all and even in regard to those cancers that generally do, isolated cases crop up in families with no history of the disease. Most cancers are considered sporadic. In people, who have sporadic cancers, they do not require several mutations. Most cancers are not hereditary; rather cancer is an acquired condition that occurs later in life. Familial aggregation of cancer occurs when cancers cluster in families and one can statistically demonstrate the risk of disease in families is greater than in the general population. A positive family history is a known risk factor for several cancers; thus, obtaining a thorough family cancer history and analyzing the pedigree is essential in cancer risk evaluation and prevention management. The aim of the study was to determine the incidence of cancer whether genetic/hereditary or environmental.

Keywords : *Cancer, Risk factors, Environmental and Hereditary cancer, Pedigree or family history.*

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Introduction:

Cancer is a group of diseases with similar characteristics which can occur in all living cells of the body. It is a multi step process and several alterations are required for a full blown cancer phenotype. All cells contain cancer genes, which when derepressed cause cancer. In normal cells, these genes are repressed (Busch H. 1962). Damage to DNA by environmental mutagens is found to be the main cause of cancer by producing mutation in germ cells and somatic cells (Doll & Peto,1981). According to epidemiological studies, 80-90% of all cancers are due to environmental factors of which life style related factors are the most important and preventable (WHO ,1997). Most cancers are considered sporadic not hereditary; rather cancer is an acquired condition that occurs later in life. Many cancers do not run in families at all and even in regard to those cancers that generally do, isolated cases crop up in families with no history of the disease. People with hereditary cancer inherit a mutated gene from their parents (Li & Fraumeni, 1969). Sporadic cancers and familial breast cancers are characterized by an increase in genetic instability. DNA mismatch repair defects involving hMLH1 and hMSH2 under expression are extremely rare events in sporadic and familial breast cancer. Mismatch repair gene mutations may be

secondary random events in breast cancer progression (Camilo *et.al*, 2003). The familial phenotype is found associated with a mutation of the BRCA2 gene cancers (Abdel *et.al*, 2007). Risks for secondary lung cancer have increased in men and women after smoking and life style related sites, and after skin cancer, non-Hodgkin's lymphoma and Hodgkin's disease. One of the clinical hallmarks of hereditary cancer susceptibility disorders is a younger-than-usual age at diagnosis. In India, most of the cancers are seen in the age group of 41-50 years (Malhotra *et.al*, 2001; Sen *et.al*, 2002). A large proportion of lung cancers before age of 50 years appears to be heritable and probably due to a high penetrant recessive gene or genes that predispose to tobacco carcinogens (Hemminki & Eng, 2004). The familial risks for offspring cancer may be increased at 24 of 25 sites when a parent is diagnosed with concordant cancer, at 20 of 24 sites when a sibling is affected, and at 14 of 16 sites when a parent and at least one other sibling are affected. At many sites, the risks between siblings are found higher than those between offspring and affected parents, probably in part because of childhood environmental effects (Hemminki *et.al*, 2009).

A positive family history among first-degree relatives is reported by 10.9% (95% Confidence Interval, CI

= 8.8–13.3) of respondents for breast cancer, 5.1% (95% CI = 3.9–6.7) for colorectal cancer, 7.0% (95% CI = 5.2–9.4) for prostate cancer, and 6.4% (95% CI = 4.9–8.3) for lung cancer (Mai *et al.*, 2010). A positive family history is a known risk factor for several cancers; thus, obtaining a thorough family cancer history is essential in cancer risk evaluation and prevention management.

The objective of the present work was to study the pedigree or family history of cancer patients.

To evaluate whether cancer is genetic/hereditary or environmental disorder.

Materials and Methods:

The data for the cancer study was collected from the patients visiting / admitted in Radiology and Oncology department of Indira Gandhi Medical College (IGMC), Shimla. For family history pedigree analysis was done. The history of the family, the probands, their current age and cancer in other relatives was taken into consideration. The family tree or pedigrees was constructed up to three generation by using the standard symbols and genetic analysis was done. Statistical analysis was done with the help of SPSS.

Results And Discussion:

From the studied population the percentage of individuals affected with cancer was found 3.46% and the

percentage of unaffected individuals was 96.54%. (Table-1; Fig-1). In case of male population, the percentage of individuals affected with cancer was 3.50% and unaffected 96.50%. In case of female population, the percentage of individuals affected with cancer was 3.42% and unaffected 96.58%. (Table 1; Fig-2,3). The cancer incidence rate in India is less than that of the western countries but due to the large population size, number of cases is more prevalent at any time (Krishnan & Sankaranarayanan, 1991).

Percentage of environmentally affected individuals was 3% in both male and female population (Table 1; Fig-1,2,3). From the present study, it was revealed that environmental factors played main role in causing cancer. As in both male and female population, the incidences of cancer in families was low. The studies carried out by others also observed that environmental factors caused human cancers (Higginson, 1980; Uaino *et al.*, 1980; Weisburger *et al.*, 1980; Wynder, 1980).

The percentage of hereditary affected or familial individuals in both male and female population was 0.46% (Table-1; Fig-1). In Male population, the percentage of hereditary affected or familial individuals was 0.49% (Table-1; Fig-2). In Female population it was 0.42 % (Table-1; Fig-3). Other study revealed that a large proportion

of lung cancers before age 50 years appears to be heritable and probably due to a high penetrant recessive gene or genes that predispose to tobacco carcinogens (Li & Hemminki, 2003).

Age-wise investigations of cancer indicated that the percentage of cancer in male was more prevalent in the age group 40-50yrs = 25%.in 50-60yrs 26%. In 60-70yrs was 24%.In female population, percentage of cancer was more in age group 40-50yrs =27.4% and in 50-60yrs = 22% (Table-2.; Fig- 4,5).On comparing the both population the percentage of cancer was maximum in the age 40-50yrs (27.4%) in female and in the age 50-60yrs (25%) in male population (Table 2; Fig-6).Most of the cancers are seen in the age group of 41-50years .The peak age for breast cancer is between 40 and 50 years in the Asian countries, whereas the peak age in the Western countries is between 60 and 70 years. Also, the incidence of breast cancer in Asia is rising and is associated with increased mortality. In the West, although the incidence is increasing, the mortality rate is definitely decreasing (Leong *et.al.*,2010).

Very low percentage of hereditary/familial cancer was found and there was no pattern of particular inheritance in families as it was observed that if a person had a specific type of cancer ,the same type of cancer was not

noted in other members but different type of cancer was noted and in some cases the both husband and wife who had no blood relation suffered from cancer which indicate again that they shared the common environment which may be the cause of cancer. In the pedigree study of few familial throat cancer it was observed that both father and son had habit of smoking. An individual's susceptibility is partly determined by environmental exposure and by the combination of inherited cancer susceptibility and resistance genes (Ewart *et.al*, 2004).

Conclusion:

From the present investigations, it is revealed that the changed lifestyle, dietary habits, pollutants and other mutagens have caused cancer more than the genetic factors. Most of the cancers are seen in the age group of 41-50years and are due to environmental factors,as hereditary cancer occurs in younger age.Although the incidence of cancer has increased due to environmental factors so it can be controlled. There is further need for research in this field so that preventive measures can be adopted.

Table. 1. Environmental and Hereditary Malignancy in Male & Female population.

Sex	Total No. of Individuals	Affected with Cancer	Unaffected	Environmental Cancer	Hereditary/Familial Cancer
Male	3685	129 (3.50%)	3556 (96.50%)	111 (3.1%)	18 (0.49%)
Female	4212	144 (3.42%)	4068 (96.58%)	126 (3%)	18 (0.42%)
Total	7897	273 (3.46%)	7624 (96.54%)	237 (3%)	36 (0.46%)

Table. 2. Age-wise distribution of Cancer in Male & Female population

Sr No.	Age in yrs	Male (120)	%age Cancer	Female (135)	%age
1	0-10	6	5%	1	0.74%
2	11-20	6	5%	2	1.48%
3	21-30	1	0.8%	11	8.1%
4	31-40	5	4.2%	22	16.1%
5	41-50	30	25%	37	27.4%
6	51-60	31	26%	30	22%
7	61-70	29	24%	23	17.3%
8	71-80	9	7.5%	5	3.7%
9	81-90	3	2.5%	4	3%

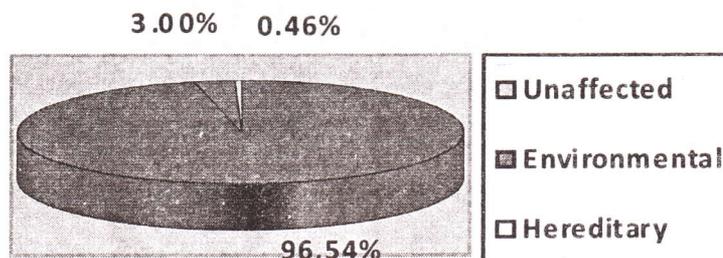


Fig.1. Percentage frequency of Environmental and Hereditary cancer in both male and female Population.

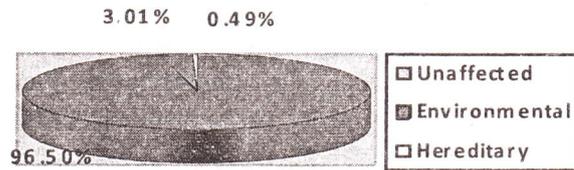


Fig.2(In Male).Percentage frequency of Environmental and Hereditary cancer

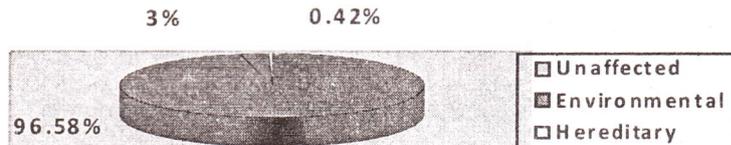


Fig.3 .(In Female)Percentage frequency of Environmental and Hereditary cancer

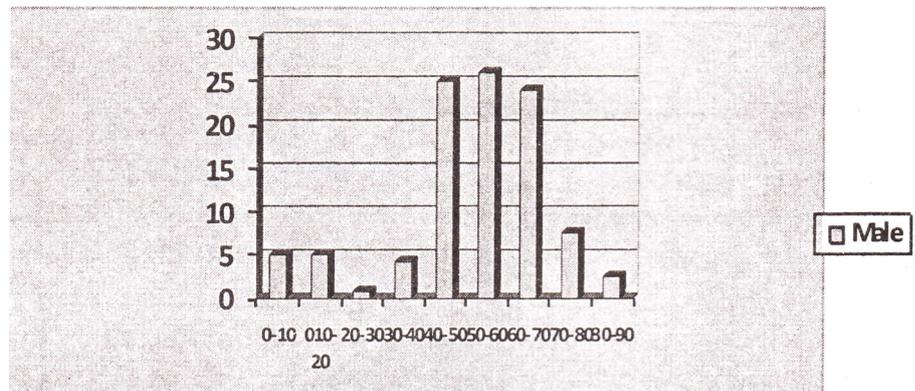


Fig.4. Age-wise distribution of Cancer in Male Population

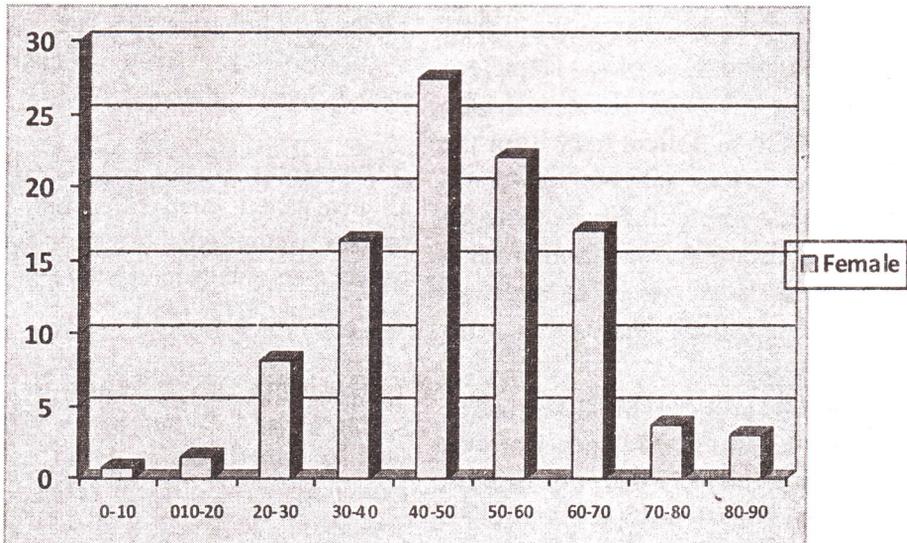


Fig.5. Age-wise distribution of Cancer in Female Population

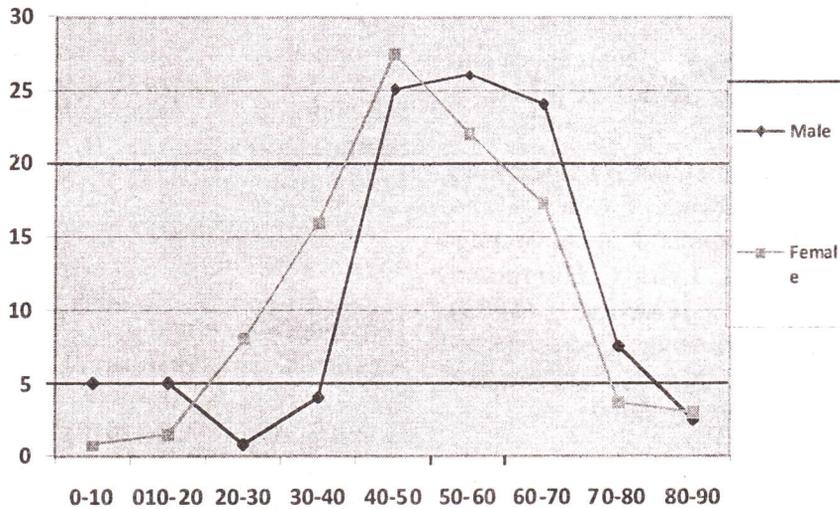


Fig.6. Percentage of Cancer in Both Male and Female Population Age-wise

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